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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/747,583	12/21/2000	Daniel Leibholz	SMQ-023	3889

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BOSTON, MA 02109

EXAMINER

HUISMAN, DAVID J

ART UNIT	PAPER NUMBER
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2183

DATE MAILED: 12/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/747,583	Applicant(s) LEIBHOLZ ET AL.	
	Examiner David J. Huisman	Art Unit 2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 September 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1-19 have been examined.

Papers Submitted

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: Extension of Time, RCE, and Amendment as received on 9/23/2005.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-13 and 16-19 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin U.S. Patent Number 6,631,452 (as applied in the previous Office Action).

5. Referring to claim 1, Lin has taught a microprocessor, comprising:

a) registers for holding values, wherein said registers are logically partitioned into register windows. See Fig.2, Fig.4, and column 4, lines 1-29, and note that the frames are the register windows.

b) a storage for storing values held in the registers of the register windows. See Fig.2, Fig.4, and column 4, lines 1-29, and note the backing store.

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c) a detector for detecting that one of a register window overflow condition and a register window underflow condition is imminent. See column 3, lines 59-67, column 4, lines 12-17, and column 4, lines 39-42, and note that the inactive (parent) procedures are tracked, and the system detects that these procedures will be returned to soon, and consequently, underflow may be imminent (there may not be enough available data to the procedure when it takes control). The system always detects that underflow/overflow is imminent, and this is the reason it issues speculative spills/fills when it can. As shown in the aforementioned passages, if two procedures are inactive, then the system detects that overflow/underflow with respect to those inactive procedures is imminent and therefore, performs speculative spills/fills for those procedures. If a third procedure then became inactive, the system would detect that underflow, for instance, is imminent with respect to that third procedure and therefore, perform speculative fills for that procedure.

d) an instruction generator responsive to the detector for generating at least one instruction to manipulate the storage to avoid a trap to avoid stalling the microprocessor, wherein the trap performs at least one of a register window spill operation or a register window fill operation responsive to the condition that is detected as imminent. See column 2, line 47, to column 3, line 5, and column 3, lines 59-67. It should be noted that in response to detecting inactive procedures, and consequently, detecting that underflow (for instance) is imminent, speculative spills/fills are performed. And, the successful performance of speculative spills/fills eliminates the need for performing mandatory spills/fills. See column 5, line 42, to column 6, line 2. In the case when a speculative spill/fill is successful, the mandatory spill/fill would be unnecessary as the speculative spill/fill has already completed the task to be performed by the mandatory

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spill/fill. This prevents the stall associated with the mandatory spill/fill from being incurred.

When a speculative spill/fill is successful, then the associated mandatory spill/fill is avoided.

This is clearly Lin's intention as the purpose of Lin's system is to reduce stalls associated with mandatory spills/fills.

6. Referring to claim 2, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the detector and the instruction generator are implemented in hardware. See column 11, lines 1-15.

7. Referring to claim 3, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the microprocessor further comprises a cache for caching instructions (Fig. 1, component 130) for introduction into an execution stage and wherein the detector examines the instructions in the cache to determine if a register window overflow condition is imminent by determining if execution of any of the fetched instructions will result in a register window overflow condition. Again, it should be realized that by executing fetched instructions of the active procedure (from a cache), the system is detecting that an overflow is imminent, i.e., that the active procedure may need more registers. Therefore, speculative spills will be issued. The instructions in the cache are the same instructions that are to be executed. No matter what point the instructions are monitored, they are "the instructions in the cache". That is, applicant is not claiming that the instructions are monitored while in the cache and before being fetched from the cache for decoding, execution, etc. Applicant merely claims monitoring instructions in the cache and an instruction that is being executed is also an instruction in the cache as that is where it was fetched from.

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8. Referring to claim 4, Lin has taught a microprocessor as described in claim 3. Lin has further taught that the detector looks for an instruction in the cache that stores contents of a register window in the registers when the registers have no available space for storing the contents (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6, column 8 line 49-column 9 line 5).

9. Referring to claim 5, Lin has taught a microprocessor as described in claim 3. Lin has further taught that the detector examines how much storage space is available in the registers (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6, column 8 line 49-column 9 line 5).

10. Referring to claim 6, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the microprocessor further comprises a cache for caching instructions for introduction into an execution stage and wherein the detector examines the instructions in the cache to determine if a register window underflow condition is imminent by determining if execution of the instructions will result in a register window underflow condition. Again, it should be realized that by executing fetched instructions of the active procedure (from a cache), the system is detecting that an underflow is imminent, i.e. that an inactive procedure will be returned to (and not have the required data available). Therefore, speculative fills will be issued to speculatively load that data. The instructions in the cache are the same instructions that are to be executed. No matter what point the instructions are monitored, they are "the instructions in the cache". That is, applicant is not claiming that the instructions are monitored while in the cache and before being fetched from the cache for decoding, execution, etc. Applicant merely

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claims monitoring instructions in the cache and an instruction that is being executed is also an instruction in the cache as that is where it was fetched from.

11. Referring to claim 7, Lin has taught a microprocessor as described in claim 6. Lin has further taught that the detector looks for an instruction in the cache that restores a register window when contents of the register window are stored on the stack rather than in the registers (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 6, column 8 line 49-column 9 line 5).

12. Referring to claim 8, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the detector detects solely whether a register window underflow condition is imminent (Lin column 11 lines 40-43).

13. Referring to claim 9, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the detector detects solely whether a register window overflow condition is imminent (Lin column 11 lines 35-39).

14. Referring to claim 10, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the detector detects both whether a register window overflow condition is imminent and whether a register window underflow condition is imminent. It should be noted that spills and fills are performed in response to detecting overflows and underflows, respectively.

15. Referring to claim 11, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the microprocessor further comprises an execution unit for executing the instruction generated by the instruction generator (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 4).

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16. Referring to claim 12, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the microprocessor performs out of order execution of instructions (Lin column 3 lines 32-45; speculative processing by definition is not a certain operation, but is a prediction based on some information, and because of a misprediction, the wrong order of operations will occur).

17. Referring to claim 13, Lin has taught a microprocessor as described in claim 1. Lin has further taught that the instruction generator includes a second storage for holding the at least one instruction that is generated by the instruction generator (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract; it is inherent that some ROM or other memory would be available to hold the speculative operations, that the RSE chooses to executes).

18. Referring to claim 16 Lin has taught a microprocessor having a plurality of registers logically partitioned into register windows and a storage for storing contents of register windows, a method, comprising the steps of:

a) determining that one of a register window overflow condition and a register window underflow condition is imminent by performing a logic operation on a value representative of a state of a register and a value representative of an instruction held in cache. See column 3, lines 59-67, column 4, lines 12-17, and column 4, lines 39-42, and note that the inactive (parent) procedures are tracked, and the system detects that these procedures will be returned to soon, and consequently, underflow may be imminent (there may not be enough available data to the procedure when it takes control). The system always detects that underflow/overflow is imminent, and this is the reason it issues speculative spills/fills when it can. As shown in the aforementioned passages, if two procedures are inactive, then the system detects that

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overflow/underflow with respect to those inactive procedures is imminent and therefore, performs speculative spills/fills for those procedures. If a third procedure then became inactive, the system would detect that underflow, for instance, is imminent with respect to that third procedure and therefore, perform speculative fills for that procedure. Also, see column 6, lines 16-23, and Table 2 in column 8. The value representative of a state of a register would be the RSE.StoreReg, which holds the next dirty register to be spilled. And, the value representative of an instruction held in the cache would be the RSC.mode value. This value indicates, for the current instruction in the cache, whether or not speculative mode is used. A logic operation is performed on these values. The logic operation is a compare of the type "if a dirty register exists in RSE.StoreReg, and speculative mode is enabled, then perform a speculative spill when possible." As long as there is a value in StoreReg which should be spilled, then overflow is imminent. That is, data may need to use this register when a new procedure is switched in, but the register cannot be used until it is spilled. So, the presence of a dirty register indicates that underflow/overflow is imminent.

b) in response to determining that the one of the register overflow condition and register window underflow condition is imminent, manipulating the storage to avoid a trap performing at least one of a register window spill operation or a register window fill operation responsive to the condition determined as imminent (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract). It should be noted that the purpose of successfully performing speculative spills/fills is to eliminate the need for performing mandatory spills/fills. See column 5, line 42, to column 6, line 2. In the case when a speculative spill/fill is successful, the mandatory spill/fill would be unnecessary as the speculative spill/fill has already completed the

task to be performed by the mandatory spill/fill. This prevents the stall associated with the mandatory spill/fill from being incurred. When a speculative spill/fill is successful, then the associated mandatory spill/fill is avoided. This is clearly Lin's intention as the purpose of Lin's system is to reduce stalls associated with mandatory spills/fills.

19. Referring to claim 17, Lin has taught a method as described in claim 16. Lin has further taught that when it determined that a register window overflow condition is imminent, the step of manipulating the storage comprises providing at least one instruction for execution by the microprocessor that causes the contents in at least the selected register window to be stored in the storage (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract).

20. Referring to claim 18, Lin has taught a method as described in claim 16. Lin has further taught that when it is determined that a register window underflow condition is imminent, the step of manipulating the storage comprises providing at least one instruction for execution by the microprocessor that causes data in the storage to be stored in the registers (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract).

21. Referring to claim 19, Lin has taught a method as described in claim 16. Lin has further taught that the microprocessor has an instruction stream slated for execution and wherein the instruction that causes the contents in at least the selected register window to be stored in the storage is inserted into the instruction stream (Lin column 7 line 45-column 8 line 15, column 5 line 46-column 6 line 2, abstract, figure 4; the instruction stream is the operations in figure 4 that spill and fill the registers from memory).

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22. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

23. Claims 14-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Eickemeyer et al., U.S. Patent No. 5,377,336 (herein referred to as Eickemeyer).

24. Referring to claim 14, Eickemeyer has taught in a microprocessor having a storage and registers, an engine, comprising:

a) a detector for detecting an instruction in a cache prior to execution of said instruction indicating that a trap requiring an access to the storage to manage register window information is imminent. See column 3, lines 30-47, and claim 1. Note the system scans for load instructions prior to their execution, where loads require an access to storage to manage register window information.

b) an instruction generator responsive to the detector for generating at least one instruction to avoid the trap performing at least one of a register window spill operation or a register window fill operation. See the abstract, column 3, lines 30-47, and claim 1. Note that in response to detecting the load, a prefetch instruction is generated in order to instruct the system to perform a prefetch operation. As a result, the system prefetches data which is ultimately written to a register. Hence, a prefetch is an operation associated with filling registers, i.e., it is a register fill operation.

25. Referring to claim 15, Eickemeyer has taught a microprocessor as described in claim 14. Eickemeyer has further taught that the engine is implemented in hardware. See claim 1, Fig. 1, and Fig. 2.

Response to Arguments

26. Applicant's arguments filed on September 23, 2005, have been fully considered but they are not persuasive.

27. Applicant argues the novelty/rejection of claim 1 on page 7 of the remarks, in substance that:

"...the speculative spill and fill operation of Lin merely reduce the need for mandatory spill and fill operation and since mandatory spill and fill operations may cause the processor to stall, Lin does not avoid stalling the microprocessor and hence does not disclose a detector and an instruction generator responsive to the detector for generating at least one instruction to manipulate the storage to avoid a trap to avoid stalling the microprocessor."

28. These arguments are not found persuasive for the following reasons:

a) It appears that applicant is arguing that the teaching of reducing stalls in a processor does not read on avoiding stalls in a processor. The examiner does not agree. Clearly, if stalls are reduced, then stalls are avoided. That is, if a speculative spill/fill is performed, then a stall associated with the corresponding mandatory spill/fill is avoided. The purpose of performing speculative operations is to avoid stalling down the road.

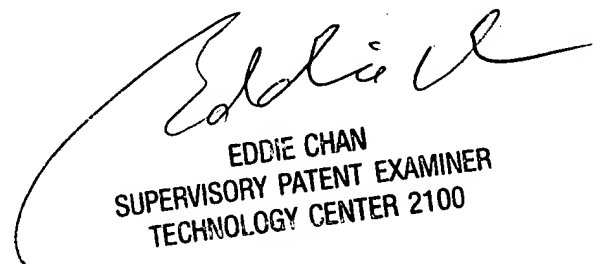
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David J. Huisman whose telephone number is (571) 272-4168. The examiner can normally be reached on Monday-Friday (8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DJH
David J. Huisman
December 12, 2005



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